

REMARKS

This Amendment is being filed in response to the Office Action dated March 28, 2008. No new matter is introduced by this amendment. For the following reasons this application should be allowed and the case passed to issue.

Claims 3-5 are pending in this application. Claims 1-5 were rejected. Claim 3 has been amended in this response. Claims 2 and 3 have been canceled in this response.

Claim Rejections Under 35 U.S.C. § 112

Claims 1-5 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite because it is allegedly unclear what parameters fall under the categories of external and internal in claim 1, and whether the claimed redox flow battery is further limited in claim 2. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

Claims 1 and 2 have been cancelled and claim 3 has been amended to be in independent form. In view of this amendment, Applicants submit that the claims fully comport with the requirements of 35 U.S.C. § 112.

Claim Rejections Under 35 U.S.C. § 103

Claims 1-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hasegawa et al. (US 2001/0012211) in view of Oga et al. (JP 2000-073932) and Clarke et al. (WO 03/017407). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is a comparison between the present invention, as claimed, and the cited prior art.

An aspect of the invention, per claim 3, is a method of designing a redox flow battery system comprising the steps of determining an average value of output distribution of the redox flow battery for smoothing an output of power generation of generating equipment that varies

irregularly in output of power generation, and a standard deviation, and determining at least one of a specified output of battery, number of batteries, specified output of the DC/AC converter for converting the battery output, and number of DC/AC converters for converting the battery output, based on the average value and the standard deviation.

The Office Action asserted that Hasegawa et al. teach a method of designing a rechargeable battery system comprising a rechargeable battery but is silent as to using averages and standard deviations; and redox flow batteries. The Office Action relied on the teaching of Oga et al. of determining an average value of variables of generator output and using the standard deviation value to determine the optimum value of electric power. Clarke et al. is relied on for teaching a rechargeable cerium zinc oxide redox flow battery.

Hasegawa et al., Oga et al., and Clarke et al., whether taken in combination, or taken alone, do not suggest the claimed method of designing a redox flow battery because Hasegawa et al., Oga et al., and Clarke et al. do not suggest the steps of determining an average value of output distribution of the redox flow battery for smoothing an output of power generation of generating equipment that varies irregularly in output of power generation, and a standard deviation, and determining at least one of a specified output of battery, number of batteries, specified output of the DC/AC converter for converting the battery output, and number of DC/AC converters for converting the battery output, based on the average value and the standard deviation, as required by claim 3.

Hasegawa et al. provide a rechargeable battery system between power generation equipment and a power system consuming power. Hasegawa et al. disclose a technique to control an active power and a reactive power that are output from the rechargeable battery system in order to stabilize load fluctuations in a customer's equipment and significant

fluctuations in the power generation equipment. A power system stabilization system employing the rechargeable battery system of Hasegawa includes a detection circuit detecting a difference between the current state and a predetermined active power and reactive power, which should be held by a power system connecting the power generation equipment and the power system consuming power together. The rechargeable battery system controls its output in correspondence with the detected results. See Hasegawa et al. paragraphs [0012] and [0013].

Accordingly, the technique disclosed in Hasegawa et al. defines a method for controlling the active power and the reactive power from the rechargeable battery system in order to stabilize load fluctuations in the power system. Hasegawa et al. do not disclose a technique for determining the optimum scale of the rechargeable battery system that is coupled to the power generation equipment.

Oga et al. do not cure the deficiencies of Hasegawa et al. Oga et al. is related to wind power generating equipment in which a NaS battery and a charging and discharging device are provided. The NaS battery of the Oga et al. has (1) an instantaneous capacity at 1-2 times the standard deviation value of the generated output obtained on the basis of the wind power generating equipment, and (2) a charging and discharging time capacity of 4-8 hours. The charging and discharging device charges and discharges electricity using the NaS battery. Oga et al. teach that fluctuation of the generated output of the wind power generating equipment can be compensated, regardless of a change of wind speed. Because the invention of Oga et al, employs wind power that is irregular and unsettled as power source, total output through a year of wind power generator is statistically observed and a variations from the average output value is obtained. On the basis of this variation, the capability of the NaS battery is determined. Furthermore, the NaS battery having a capability to generate substantially equal output to the

variation obtained in that way is combined with the wind power generating equipment. Thus, Oga et al. determine the capability of the NaS battery on the basis of the variation in output of wind power generator, which is statistically calculated.

On the other hand, in the present invention, the optimum scale of the redox flow battery combined to the power generator is not determined based on the variation in the statistically calculated output of wind power generator, but rather is determined from a variation in the statistically calculated required output of the redox flow battery itself.

Differences in between Oga et al. and the present invention are explained with the specific examples below.

Fig. A (Case applied to D3, D4)

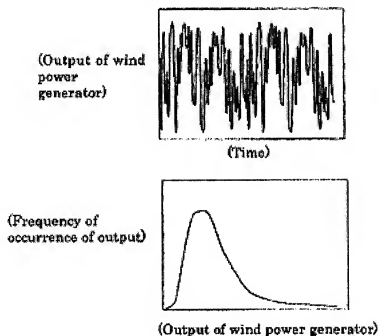
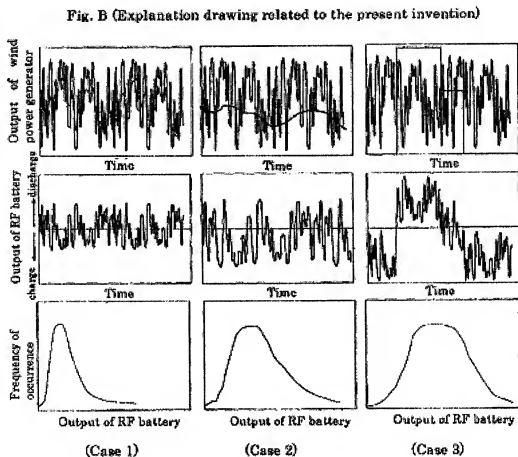


Fig. A shows an example of the output of the wind power generator and frequency of occurrence of output of the wind power generator. When the technique of Oga et al. is used, the standard deviation is obtained from the characteristics of the frequency of occurrence of output, and then, the output of NaS battery is determined based on this single factor. See Oga et al., paragraph 0014 and Fig. 3.

Fig. B below shows the technique of the present invention. The examples of output of wind power generator are the same as Fig. A above.



Case 1 and Case 3 illustrate when the redox flow batteries work for stabilizing or smooth the output of the battery system when the redox flow battery is combined to the wind power

generator. Reference curves shown in the first row in the images show the output of the battery system to be achieved when smoothing the output (total output of the wind power generator plus redox flow battery).

In Case 1, the output of the battery system is smoothened over a short period (intended use of the redox flow battery: smoothing output),

in Case 2, the output of the battery system is smoothened over a long period (intended use of the redox flow battery: smoothing output); and

in Case 3, the total output of wind power generator plus redox flow battery is generated as a predetermined pattern (intended use of the redox flow battery: equalizing of load). In case 3, the redox flow battery absorbs the total output of the wind power generator in the nighttime while generating output in the daytime so as to make the total output of the wind power generator plus the redox flow battery the desired pattern.

Images in the second row show the required output discharged from the redox flow battery (= desired output (reference curve) – actual output of wind power generator).

Images in the third row show the frequencies of occurrence of the output of the redox flow battery.

As clearly illustrated in these Figures, the required output is different in each case when the intended use of the redox flow battery is different. In Fig. B, a greater magnitude of output is required in the order: Case 1 → Case 2 → Case 3. Similarly, variations in output swing in a wider range in the order: Case 1 → Case 2 → Case 3. That is, if the wind power generator is combined to the redox flow battery, the optimum scale of the redox flow battery is changed by its practical use. In other words, the method of Oga et al. is unable to design the optimum scale of the redox flow battery because only a single factor (output of wind power generator) is

considered to determine the scale or the magnitude of output of the NaS battery. To the contrary, in the present invention, the redox flow battery is designed based not on the variation in wind power generator output, but the variation in the required output of the redox flow battery. Therefore, the present invention allows the optimum scale of the redox flow battery suitable for the specific practical use to be designed.

As explained above, according to Oga et al., a designer cannot select how to stabilize or smoothen the variation in output of the wind power generator by the NaS battery. The designer is merely able to design a NaS battery based on a single factor, that is, the variation in output of the wind power generator. In short, the "output of NaS battery" corresponds to the "variation in the output of the wind power generator" only. Accordingly, a NaS battery suitable for practical use cannot be designed.

On the other hand, the method of the present invention can design the redox flow battery with an optimum scale suitable for the practical use, (smoothing output, equalization of load, countermeasure to voltage sag, etc.) when combined with a wind power generator or the like to stabilize or smoothen the output of wind power generator. Therefore, the method of the present invention is superior in capability for use in a wide-range of applications. Thus, the method of the present invention is completely different from Oga et al. and achieves superior results.

Clarke et al. do not cure the deficiencies of Oga et al. and Hasegawa et al. Clarke et al. disclose load leveling batteries that employ a redox flow battery in which an electrolyte includes a cerium-zinc redox pair, and the reduction of cerium and oxidation of zinc produce current provided by the battery. In other words, the technique disclosed in Clarke et al. indicate that a redox flow battery is effective to level a load. Clarke et al. do not suggest which information should be obtained and considered to determine the optimum scale of the redox flow battery

when the battery is combined to a power generator that is irregular and unsettled, such as a wind power generator.

As explained above, there are clear differences between the present invention and the cited references. Additionally, the present invention achieves remarkable working results, which cannot be achieved in the cited references. Therefore, the present invention is clearly unobvious in view of the of the combination of the cited references.

Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). There is no suggestion in Hasegawa et al., Oga et al., or Clarke et al. to modify the method of Hasegawa et al. to include the steps of determining an average value of output distribution of the redox flow battery for smoothing an output of power generation of generating equipment that varies irregularly in output of power generation, and a standard deviation, and determining at least one of a specified output of battery, number of batteries, specified output of the DC/AC converter for converting the battery output, and number of DC/AC converters for converting the battery output, based on the average value and the standard deviation, as required by claim 3, nor does common sense dictate such a modification. The Examiner has not provided any evidence that there would be any obvious benefit in making such a modification of Hasegawa et al. *See KSR Int'l Co. v. Teleflex, Inc.*, 500 U.S. ____ (No. 04-1350, April 30, 2007) at 20.

The only teaching of the claimed method of designing a redox flow battery is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must and not be based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The dependent claims are allowable for at least the same reasons as claim 3 and further distinguish the claimed method.

In view of the above amendment and remarks, Applicants submit that this case should be allowed and passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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